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## BETWEEN-MEAL FOOD INTAKE FOR RESERVISTS TRAINING IN THE FIELD

U S ARMY RESEARCH INSTITUTE  
OF  
ENVIRONMENTAL MEDICINE  
Natick, Massachusetts

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Human subjects participated in these studies after giving their free and informed voluntary consent. Investigators adhered to AR 70-25 and USAMRDC Regulation 70-25 on Use of Volunteers in Research.

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BETWEEN-MEAL FOOD INTAKE FOR RESERVISTS  
TRAINING IN THE FIELD

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April 1989

#### FOREWORD

The information contained in this technical report is derived from the data collected for the technical report, Effectiveness and Acceptability of Nutrient Solutions in Enhancing Fluid Intake in the Heat. Complete food and fluid intake were collected for soldiers working for 8 days in the heat. The data were collected in sufficient detail to make it possible to analyze the data for A-ration meals, Meal, Ready-to-Eat (MRE) rations, and between-meal foods.

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## INTRODUCTION

The food intake of soldiers in the field has been studied repeatedly (1-8). However, the completeness of the data is sometimes questionable. Anecdotal stories indicate that soldiers do not restrict their food intake to the rations that are served in the field, but bring their own favorite foods to supplement the rations. Complete food consumption data usually are collected on the military rations; however information on the extra foods eaten between meals is more difficult to collect and quantitate. This source of nutrient intake was not collected and/or analyzed in some field (4,9) and dining facility studies (10-12). Some field studies have controlled the sources of between-meal food intakes by checking all rucksacks for unauthorized food (7) or by utilizing the chain of command to strongly discourage the consumption of non-issued food items in the field (1). If between-meal food data are collected, their contributions to overall nutrient intakes are included in the totals. The study by Roberts et al. (6) was one of the few ration studies that reported the nutrient intakes from non-ration food items separately. Published data are generally not available on the types and the amounts of between-meal foods that are eaten in the field. The objective of this technical report was to describe the types and amounts of between-meal foods that

were eaten by reserve soldiers working 8 days in the field in a hot environment.

## METHODS

The data for this technical report were collected as part of a larger study on the acceptability and effectiveness of the carbohydrate-electrolyte solutions in enhancing fluid intake in the heat (3). The methods are reported in detail by Rose et al. (3); however, the methods are described briefly here. Volunteers were recruited from reservists of the 44th Evacuation Hospital, 807th Medical Brigade, participating in a field training exercise at Fort Hood, TX during June 1988. Data from 61 subjects are included in this data analysis even though 6 of the 61 subjects did not complete the entire study. In general, the activity level of the soldiers averaged out to moderate activity. There were spurts of heavy and light activity as the soldiers erected and lived in tents in the field for the 8 days of the exercise. Some of the soldiers attended classes in garrison during the day. On Day 5 of the study, all soldiers, including the test subjects, were allowed to return to garrison in the afternoon to shop at the PX, take showers, attend movies, etc. The subjects returned to the field by 2200 hours that night.

The subjects were allowed to consume foods and fluids ad libitum. Data were collected for the: a) A ration meals served at the breakfast and dinner meals (dinner changed to lunch on day 5); b) Meals, Ready-to-Eat version 6 (MRE) for lunch; c) between-meal foods and fluids eaten during the period 1630-0530 hours (PM

card); and d) between-meal foods and fluids eaten during the period 0530-1630 hours (AM card) except Day 5 when the data from the AM and PM cards were combined and collected at 0530 hours on Day 6. Information on food and fluid intake at the two hot A-ration meals was collected by the nutrition data collectors using a modified visual estimation method (13) developed at the U.S. Army Research Institute of Environmental Medicine (USARIEM). In this method, the subject showed his food selections to the data collector, ate his meal, and showed his tray to the data collector again. The data collector compared the food portions to pre-weighed standards to estimate portion size. Information on the intake of the MRE were recorded separately by the subjects on the front of the food and fluid intake cards. All the MRE food components were listed on the food and fluid intake cards and the subjects were asked to circle the food and amount eaten. The MREs were issued to the soldiers at the breakfast meal to be eaten at the lunch meal. On Day 5 the breakfast and lunch meals were A-rations and the MRE was issued for the dinner meal. All extra foods brought to the field, purchased from the PX mobile kitchen, and eaten at restaurants or fast food establishments were recorded on the back of the between-meal food and fluid intake cards. Data were collected on 100% of the A-ration meals served in the field and only 4% of the between-meal data forms were missing. The missing data will cause the energy and fluid intake to be slightly underestimated.

## RESULTS AND DISCUSSION

Physical characteristics of subjects participating in this study are listed in Table 1. The weights in the table are the weights of the reservists at their home station (Oklahoma City, OK or El Paso, TX) before the soldiers were transported to Fort Hood, TX. Some data were missing on height because some soldiers did not fill in the final questionnaire with the demographic data. The subjects lost less than 1 kg body weight over 8 days and therefore were very close to ingesting their energy requirements. The subjects were almost evenly divided by gender and military rank. About 45% of the volunteers had served in the military for less than 5 years.

Table 1. Physical characteristics of subjects.

VARIABLE	NUMBER	MEAN+SEM	MINIMUM	MAXIMUM
Age, years	61	33.6 $\pm$ 1.1	19	51
Height, cm	51	173.5 $\pm$ 1.5	152	198
Weight, kg*	61	75.4 $\pm$ 2.0	41.5	128.2

\*Pre-deployment weight

As reported previously (3), 13% of the field meals were skipped deliberately (Table 2) and most were breakfast meals. About 55.5% of the skipped meals were breakfast meals and 44.5% were dinner meals. Since all soldiers were wakened for formation just prior to the breakfast meal most of the skipped breakfasts

were probably deliberate. The hot A-ration meals were popular since 19 of the 61 subjects ate all the A-ration meals that were served in the field. Most of the soldiers (85%) missed 3 meals or less of a possible 16 (2 meals/day x 8 days) meals. Data show that one person skipped 11 meals and 1 person skipped 15 meals (Table 2). The subject who missed 15 meals had come prepared to skip all meals. She was attempting to lose weight and had brought her own food: yogurt, distilled water, skim milk, etc.

Table 2. Distribution of subjects according to the number of meals skipped.

NUMBER OF MEALS SKIPPED	NUMBER OF SUBJECTS
0	19
1	13
2	10
3	10
4	2
5	2
6	2
7	1
8	0
9	0
10	0
11	1
12	0
13	0
14	0
15	1
16	0
TOTAL	61

Adapted from reference #3.

The subject who missed 11 meals was coordinating administrative details of the FTX and so skipped many of the meals served in the field, but he was recording his food intake on the between-meal food and fluid intake card.

The mean intake for the 26 males who completed all 8 days of the study (3) was  $3056 \pm 74$  kcal/day which is less than the Military Recommended Dietary Allowances (MRDA) of 3200 kcal/day set for moderately active male military personnel, ages 17 to 50 years (14). Compared to the mean male intakes, the intakes of the 29 females were much lower at  $2343 \pm 55$  kcal/day. The daily caloric intakes ranged from a minimum of 137 kcal/day for one subject to a maximum of 6162 kcal/day for another subject. The mean male energy intake for the present study is within the range the energy intake of previous field studies where mean intakes of subjects consuming 2 A-ration meals + 1 MRE ration/day for extended periods (5-6 weeks) have been reported to be 2950 and 3271 kcal/day (1,15). A mean intake of 3713 kcal/day was reported for field artillery soldiers fed 3 A-ration meals during 8 days of sustained artillery operations in the field (2). The subjects in the present study were very close to equilibrium in their energy intake and expenditure since the mean weight loss was less than 1 kg. This group of subjects may not have needed excessive calories because they started with moderate activity (with spurts of heavy activity) during the first 3 to 4 days while setting up the hospital area, but their activity level

decreased markedly during the later days while they waited for events to occur in the FTX.

The frequency of MRE consumption is shown in Appendix A. Only about 44% of the MREs which should have been consumed in the field were eaten (215 MRE entrees consumed/8 days x 61 subjects). This percentage was very low considering that the CFFS-FDTE (1) study had shown that male and female soldiers ate about 80 and 70% of the MREs, respectively. This apparent unwillingness to eat MREs could account for some of the inadequate nutrient intakes found in this study since one MRE supplies 1200 kcal and ~1/3 of the MRDA for one meal. However, the tables (Appendix B) showing the frequency of between-meal food consumption indicate that the soldiers were not suffering from a caloric deficit.

The tables in Appendix B show the frequency of between-meal food consumption in the field. Between-meal foods include: foods brought to the field site by the reservists and foods purchased in restaurants, PX, fast food establishments, etc. Some of this between-meal food was provided by the PX mobile kitchen which made regular visits at the field site. Other foods were eaten while the soldiers were on-post on Day 5 or other days for classes. The energy values in Table 3 of the present report are slightly higher than those reported on the same subjects by Rose et al. (3) because the data in the previous technical report are based on only 55 subjects that completed all 8 days of the study. The contributions of the different food sources (A-

ration, MRE, between-meal) to overall energy intake was similar for males and females. Approximately 50% of the total energy intake was contributed by the A-ration meals, 25% from the MREs, and another 25% from the between-meal foods (Table 3). Since the energy intakes of the subjects in the present study were approximately the same as those of previous field studies (1,2,15), the caloric contribution from between-meal foods indicates that the soldiers reduced their intake of A-ration and MRE calories by 25%.

Table 3. Contribution to total energy intake of A-ration meals, MRE rations, and between-meal foods.

FOOD SOURCE	TOTAL KCAL (%)	MALES KCAL (%)	FEMALES KCAL (%)
A-RATION MEALS	1528 $\pm$ 30 (49%) <sup>a</sup>	1645 $\pm$ 43 (49%)	1404 $\pm$ 41 (51%)
MRE RATION	804 $\pm$ 27 (26%) <sup>b</sup>	892 $\pm$ 36 (26%)	672 $\pm$ 38 (24%)
BETWEEN-MEAL FOOD	761 $\pm$ 30 (25%) <sup>b</sup>	846 $\pm$ 50 (25%)	682 $\pm$ 35 (25%)
TOTAL (n=61)	3093	3383	2758

Values are Mean $\pm$ SEM

Means with unlike superscripts differ, p<0.001.

Anecdotal reports have indicated that all soldiers took foods to the field to supplement MRE meals, but no other study has generated data on the types of between-meal foods (Appendices C and D) and their contribution to the overall energy intake of soldiers working for extended periods of time in the field. The

Reservists were not restricted in the types of foods that they could take to the field because the investigators wanted normal food consumption during the field exercise. Between-meal food and fluid intakes averaged about 3.74 snacks/day/person. It is interesting that about 27% of all between-meal foods eaten in the field were fluids. A reason for the high beverage consumption could be an attempt to increase fluid intake in the heat. The soldiers participating in the present study were part of a medical unit that had received extensive training on water discipline and the importance of preventing dehydration during work in the heat. The consumption of foods from the fruit/juice, meat, snack/chips, candy/gum, bread/cereal, and dessert categories ranged from 8.1-14.6%. Less than 100 servings of the 1823 between-meal food items were consumed in each of the other categories. Most of the between-meal food items were canned or dried and did not require any refrigeration. However, a few items (yogurt, dairy products, skim milk) did require cold storage.

The results show that between-meal food intake should be included in all analyses of nutrient intake. Assuming that the amount of food that soldiers take to the field is minimal would underestimate nutrient intakes. The 25% contribution from between-meal foods in this study is probably higher than would be typical for active duty troops due to the nature of the unit studied (access to between-meal foods because of proximity to

transportation, classes in garrison, PX mobile kitchen, etc.); however, it does show that non-ration foods can affect total energy intake for soldiers eating A-rations and MREs in the field.

## CONCLUSIONS

A major percentage of the total energy intake came from non-ration food items. About 25% of the total energy consumed in the field was from between-meal foods/fluids and another 25% from MREs. Without these between-meal foods, energy intake would have been inadequate, but it cannot be determined whether having the extra between-meals foods caused the reduction of A-ration and MRE food intake at meals or whether having the between-meal foods increased inadequate intakes to adequate levels for the soldiers in the present study. The soldiers skipped 13% of the A-ration meals with the majority (55.5%) of the skipped meals at breakfast. MRE consumption for the reservists at the lunch meal in this study (44%) was much lower than the 70-80% reported previously for active duty soldiers when consumption of non-ration between-meal foods was strongly discouraged.

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APPENDIX A  
MRES EATEN DURING THE FIELD EXERCISE

FOOD ITEM NAME	CODE	FREQUENCY
APPLESAUCE, MRE	MR6601	14
BEEF PATTIES, MRE	MR6303	15
BEEF W/BBQ SAUCE, MRE	MR6304	36
BEEF STEW, MRE	MR6305	2
BEEF W/GRAVY, MRE	MR6308	27
BEEF W/SPICED SAUCE, MRE	MR6312	3
BEANS W/TOMATO SAUCE, MRE	MR6313	24
CANDY (ALL TYPES), MRE	MR6815	30
CATSUP, MRE	MR6904	5
CHICKEN A LA KING, MRE	MR6309	30
CHOC CVD COOKIE BAR, MRE	MR6801	65
CHOC CVD BROWNIE, MR	MR6803	40
CHERRY NUT CAKE, MRE	MR6804	4
CHOC NUT CAKE, MRE	MR6807	2
CHEESE SPREAD, MRE	MR6901	53
COCOA POWDER, MRE	MR6001	19
COFFEE, MRE	MR6002	10
CREAM SUBSTITUTE, MRE	MR6003	7
CRACKERS, MRE	MR6701	200
FRANKFURTERS, MRE	MR6306	19
FRUIT MIX, MRE	MR6604	46
FRUITCAKE, MRE	MR6806	30
GRAVY BASE (SOUP MIX), MRE	MR6905	1
GUM, MRE	MR6816	58
HAM/CHICKEN LOAF, MRE	MR6302	13
JELLY, MRE	MR6903	45
MAPLE NUT CAKE, MRE	MR6805	23
MEATBALLS W/BBQ SAUCE, MRE	MR6310	28
PEACHES, MRE	MR6603	46
PEANUT BUTTER, MRE	MR6906	63
PEARS, MRE	MR6109	12
PORK SAUSAGE PATTIES, MRE	MR6301	15
POTATO PATTY, MRE	MR6401	1
SALT, MRE	MR6910	15
STRAWBERRIES, MRE	MR6602	1
SUGAR, MRE	MR6909	6
TURKEY W/GRAVY, MRE	MR6307	27

**APPENDIX B**  
**FREQUENCY DISTRIBUTION BY CATEGORY OF FOODS**  
**EATEN BETWEEN-MEALS IN THE FIELD**

CATEGORY	FREQUENCY	PERCENT
Beverages	528	29.0
Fruit/Juices	267	14.6
Meat	160	8.8
Snacks/Popcorn/Chips	159	8.7
Candy/Gum	149	8.2
Breads/Crax/Rice Cakes/Cereal	148	8.1
Desserts/Cakes/Cookies/Puddings	106	5.8
Seeds/Nuts	79	4.3
Dairy Products/Cheese/Yogurt	73	4.0
Fat/Cream Cheese/Salad Dressing	29	1.6
Peanut Butter/Cheese Crax	26	1.4
Pastry	24	1.3
Condiments	23	1.3
Granola	23	1.3
Hamburger/Cheeseburger	13	0.7
Vegetables	13	0.7
Soup	3	0.2

APPENDIX C  
BETWEEN-MEAL FOODS EATEN DURING THE  
AM PERIOD (0530-1630 HR)

FOOD ITEM	FREQUENCY
APPLE, RAW	61
APPLESAUCE	5
BACON, OVEN FRIED	3
BANANA, FRESH	7
BEEF JERKEY	16
BEEF STICK	2
BISCUITS REFRIGERATED	1
BOLOGNA	2
BREAD, ASST	18
BUBBLE GUM, SUPER	3
CAKE W/VAN ICING	2
CANDY, ASST	71
CARROT, RAW, STICKS	1
CATFISH, BREADED	1
CATSUP	5
CELERY, RAW, SLICED	1
CEREAL, ASST	36
CHEESE SPREAD	4
CHEESEBURGER/HAMBURGER	9
CHEESE, CHEDDAR	1
CHEESE DANISH	1
CHEX SNACK MIX	2
CHICKEN, CANNED	3
CHICKEN, OVEN FRIED	3
CHICKEN FRIED STEAK	1
CHICKEN McNUGGETS, MCDONALD	1
CHICKEN PLANKS	1
CHICKEN SALAD	1
CHILI, VENDING	2
CHIPPED BEEF/DRIED	2
CHIPS, ASST SNACK	42
CHOCOLATE CHIPS	1
COFFEE, BREWED	32
COFFEE CREAMER	1
COOKIE, ASST	52
CORN NUT SNACK	4
COTTAGE CHEESE	2
COUGH DROPS	1
CRACKERS, ASST	52
CREAM CHEESE	6
CUPCAKE, CREAM FILLED	1
CUP-A-SOUP, BEEF VEG	1

BETWEEN-MEAL FOODS EATEN DURING THE  
AM PERIOD (0530-1630 HR) (cont'd)

FOOD ITEM	FREQUENCY
DEVILED HAM	5
DINNER ROLL	1
DONUT, FILLED, PLAIN	4
DRESSING, ASST, REG	10
EGG, BOILED or SCRAMBLED	4
FRUIT COCKTAIL IN JUICE	5
FRENCH FRIES	7
FRUIT ROLL/ROLLUP	3
FRUIT, MIXED AND DRIED	7
FUNYON'S ONION RINGS	1
GATORADE	1
GRANOLA BAR, ASST	12
GRAPEFRUIT, FRESH	1
GREEN CHILI SAUCE	1
GUM, REGULAR	3
HAM, SLICED	1
HAM SANDWICH W/CHEES	3
HERRING, SMOKED, KIPPERS	3
HOAGIE, SANDWICH	4
HONEY	1
HOT DOG, FOOT LONG	8
HOT DOG, FOOT LONG, CHILI	6
HOT SAUCE	1
HUSH PUPPIES	1
ICE CREAM,	4
JELLY, ASSORTED FLAV	4
JUICE, ASST	20
KOOLAID, ANY FLAVOR	15
LETTUCE	6
MARGARINE, PATTIE	1
MCDONALD'S SAUSAGE & EGG McMUFFIN	1
MELBA TOAST, 1 PIECE	4
MILK, CHOCOLATE, UHT	9
MILK, WHITE, UHT 2%	18
MILK, SKIM, PROTEIN	3

BETWEEN-MEAL FOODS EATEN DURING THE  
AM PERIOD (0530-1630 HR) (cont'd)

FOOD ITEM	FREQUENCY
MUFFIN, BLUEBERRY	1
NUTS, ASST	42
ONION RINGS	1
ORANGE, WHOLE	60
PEACHES, HEAVY SYRUP	6
PEANUT BUTTER SANDWICH	2
PEANUT BUTTER	16
PEARS, CANNED, IN WATER	1
PEPPER, JALAPENO	1
PIE, FRIED, FRUIT FLAVORED	2
PINEAPPLE CHUNKS, CANNED	3
PICO DIGALLO	1
PIZZA, ASST	18
PLUM, FRESH	1
POPCORN, BUTTERED & SALTED	14
POPCORN, SUGAR COATED	6
POP TARTS, FROSTED	3
PORK RINDS/SKINS	2
POTATO SALAD	1
PORK & BEANS, CANNED	7
PRUNES	5
PUDDING, SNACK PACK	4
RAISINS	11
RAISIN, YOGURT COATED	1
RAISIN BREAD	1
RICE	1
RICE CAKES, UNSALTED	2
ROLL, CINNAMON	2
ROAST BEEF, COOKED	2
SALT, INDIV PACKET	4
SARDINES, IN OIL	2
SAUSAGE, SUMMER	1
SAUSAGE	5
SAUSAGE, VIENNA	13
SODA, ASST	180
SODA, DIET	85
SOUP, READY MADE	2
STEAK SAUCE	1
SUNFLOWER SEED KERNEL	5
SUNKIST FUN FRUITS	2

BETWEEN-MEAL FOODS EATEN DURING THE  
AM PERIOD (0530-1630 HR) (cont'd)

FOOD ITEM	FREQUENCY
SUGAR, GRANULATED	3
SWISS COFFEE DRINK	1
SWEET AND LOW	1
TACO SAUCE	2
TACO SALAD	1
TEA, FROM BAG	4
TEA, ICED, PRESWEETENED	6
TORTILLA, FLOUR, 6IN	3
TOMATO, RAW, SLICED	2
TRAIL MIX	10
TUNA IN OIL	1
TUNA SALAD SANDWICH	1
TUNA IN WATER	14
TURKEY, CANNED	1
YOGURT, WEIGHT WATCHERS	4
YOGURT, ASSORTED FRUIT	2
ZINGERS, RASPBERRY	2

APPENDIX D  
BETWEEN-MEAL FOODS EATEN DURING THE  
PM PERIOD (1630-0530 HR)

FOOD ITEM	FREQUENCY
APPLE	22
APPLESAUCE	1
BACON BITS	1
BANANA, FRESH	2
BEEF STICK	1
BEEF JERKEY	9
BIG MAC, MCDONALD'S	2
BREAD, WHITE, SOFT	5
BUBBLE GUM, SUPER	1
CAKE W/CHOC ICING	1
CANDY, ASST	47
CANTALOUPE, DICED	2
CARROT, RAW, STICKS	1
CEREAL, ASST	5
CHEESE SPREAD	1
CHEESEBURGER	2
CHEESE, CHEDDAR	2
CHEESE CURLS/CHEETOS	10
CHEESE SANDWICH CRACKERS	1
CHEX SNACK MIX	3
CHICKEN, CANNED	2
CHICKEN FRIED STEAK	1
CHIP DIP, ASST	6
CHIPS, ASST	24
CINNAMON NUTROLL	1
COFFEE, BREWED	8
COOKIE, ASST	38
CORN NUT SNACK	6
CRACKERS, ASST	6
DEVILED HAM	1
DONUT, CINNAMON	3
FILET MIGNON	1
FRENCH FRIES	2
FRUIT COCKTAIL IN HEAVY SYRUP	1
FRUIT COCKTAIL IN JUICE	1
FRUIT, DRIED	1
FRUIT ROLL/ROLLUP	1
FUNYON'S ONION RINGS	2

BETWEEN-MEAL FOODS EATEN DURING THE  
PM PERIOD (1630-0530 HR) (cont'd)

FOOD ITEM	FREQUENCY
GATORADE	2
GRAVY, CREAM	1
GRANOLA BAR , ASST	11
GREEN CHILI SAUCE	1
HAMBURGER	1
HAM, SLICED	1
HERBAL TEA, ANY FLAVOR	1
HOT DOG, FOOT LONG	3
ICE CREAM BAR, CHOCOLATE	1
ICED TEA	2
JELLY, ASSORTED FLAVORS	2
JUICE, CRAN-RASPBERRY COCKTAIL	1
JUICE, CRANTASTIC	1
JUICE, GRAPEFRUIT	3
JUICE, ORANGE	5
KOOLAID, UNSWEETENED	1
KOOLAID, ANY FLAVOR	16
MARGARINE, PAT	2
MILK, WHOLE	2
MILK, CHOCOLATE, UHT	8
MILK, WHITE, UHT 2%	9
NUTS, ASST	19
NUTS, CASHEWS	5
NUTS, PEANUTS, HONEY ROASTED	5
ORANGE	19
PEANUT BUTTER SANDWICH	4
PEANUT BUTTER	3
PEACH, FRESH	1
PEARS, CANNED	1
PIE, FRIED, FRUIT FLAVORED	2
PIZZA, PEPPERONI	1
POPCORN, BUTTERED & SALTED	21
POPCORN, CHEESE FLAVORED	1
POPCORN, SUGAR COATED	3
POP TARTS, FROSTED, ASST	3
PORK RINDS/SKINS	1
POUND CAKE	1

BETWEEN-MEAL FOODS EATEN DURING THE  
PM PERIOD (1630-0530 HR) (cont'd)

FOOD ITEM	FREQUENCY
PRETZELS	6
PRUNES	1
PUDDING, SNACK PACK	2
RAISIN	1
RICE CAKES, UNSALTED	1
SARDINES, IN OIL	1
SAUSAGE, SUMMER	2
SAUSAGE, VIENNA	3
SNACK CAKE	2
SODA, ASST	115
SODA, DIET	50
SOUR CREAM	2
STRAWBERRIES, FRESH	1
SUNFLOWER SEED KERNELS	8
SWISS COFFEE DRINK	1
SWEET AND LOW	1
TEA, FROM BAG	1
TEA, ICED, PRESWEETENED	7
TRAIL MIX	6
TUNA SALAD FOR SANDWICH	1
V-8 JUICE	3
WEIGHT WATCHER'S WAFERS	3
YOGURT, ASSORTED FRUIT	1
YOGURT, WEIGHT WATCHERS	2

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